REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

1. REPORT DATE *(DD-MM-YYYY)*	**2. REPORT TYPE**	**3. DATES COVERED** *(From - To)*
10-19-2016	Final Report	1 Oct 15 – 30 Sep 16

4. TITLE AND SUBTITLE
Enhancements to Demilitarization Process Maps Program (ProMap)

5a. CONTRACT NUMBER
W15QKN-14-9-1001

5b. GRANT NUMBER
NA

5c. PROGRAM ELEMENT NUMBER
NA

6. AUTHOR(S)
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5d. PROJECT NUMBER
DOTC-15-01-INIT148

5e. TASK NUMBER
NA

5f. WORK UNIT NUMBER
NA

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10. SPONSOR/MONITOR'S ACRONYM(S)
DoD - Army

11. SPONSOR/MONITOR'S REPORT NUMBER(S)
NA

12. DISTRIBUTION / AVAILABILITY STATEMENT
Approved for public release: distribution unlimited

13. SUPPLEMENTARY NOTES
NA

14. ABSTRACT
The efficiency and capabilities of the process map tool, ProMap, was improved by implementing new features, and sharing data with MIDAS and AMDIT databases. Specifically, process efficiency was improved by 1) providing access to APE information contained in the AMDIT database directly from inside ProMap when constructing a process map, 2) providing direct access to previously constructed process maps in ProMap from the MIDAS program, 3) permitting ProMap to retrieve characterization structure information from MIDAS to ensure all parts and components are mapped correctly, and 4) providing maintenance and updates for ProMap and AMDIT to ensure user needs are addressed over the next year.

15. SUBJECT TERMS
Process Maps, MIDAS, Ammunition Peculiar Equipment

16. SECURITY CLASSIFICATION OF:			**17. LIMITATION OF ABSTRACT**	**18. NUMBER OF PAGES**	**19a. NAME OF RESPONSIBLE PERSON:** Kurt Gramoll
a. REPORT UU	**b. ABSTRACT** UU	**c. THIS PAGE** UU	UU	12	**19b. TELEPHONE NUMBER** *(include area code)* 405-503-8146

Standard Form 298 (Rev. 8-98)
Prescribed by ANSI Std. Z39.18

Final Technical Status Report

for

Enhancements to Demilitarization Process Maps Program (ProMap)

Initiative No. DOTC-15-01-INIT148

Reporting Period: Effective Date – 20 Oct 2016

Ordnance Technology Initiative Team

Gramago, LLC

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Submitted: 14 Oct 2016

1. Summary

The project successfully completed of all four tasks, including Task 1, “Completion and Implementation - APE linking system (AMDIT) and APE Catalog Access”, Task 2. “Quick Access Buttons in MIDAS to a Specific Process Map in ProMap”. Task 3, “MIDAS Framework Import into ProMap”, and Task 4, “Prototype Demonstration/validation Testing”.

Task 1 allows users of ProMap to access the APE Catalog information through ProMap. This permits users to better understand what equipment can be efficiently used to demil a particular munition. Associated with this task was the upgrade of the AMDIT database so that ProMap can access the APE linking information.

Task 2 allows MIDAS web site to access individual process maps directly. The ProMap web site was modified to accept web service calls from MIDAS so that MIDAS can determine what maps are available. The web service uses ASP.NET technology on both servers, and utilizes security measures to issue only MIDAS can request this information.

Task 3 allows ProMap users to pull munition data based on drawing or part numbers from MIDAS. The data is returned in an XML data file that relates part construction of the munition. This information is used to construct a Technology Tree (i.e. process map) based on part information. This forms the framework of the process map. ProMap users can than add process nodes to the map. Overall, this generates more accurate process maps and reduces construction time by half.

Task 4 Updated and validated capabilities of ProMap as directed by JMC-McAlester. Various updates of the program and coordination with JMC McAlester IT group were done. Server updates were also completed.

2. Initiative Quad Chart

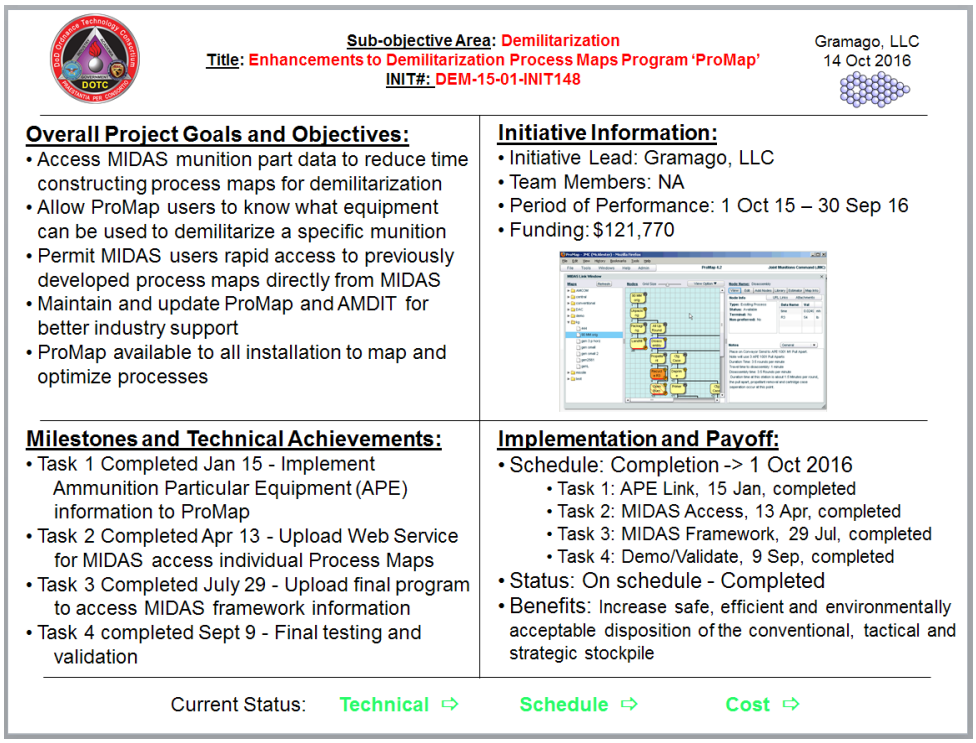


Figure 1 Quad Chart as of 14 Oct 2016
(Original PowerPoint Slide available on request)

3. Supplemental Information

3.1 Technical Achievements – Summary for Annual Report (includes all work todate)

TASK 1 - Completion and Implementation - APE linking system (AMDIT) and APE Catalog Access

The work for Task 1 involved three main efforts. First, the AMDIT database was revised and updated to allow ProMap access to the database. This included adding programming scripts to the AMDIT web site so that ProMap can call the scripts and access information. This information can only be pulled from the database. ProMap program cannot change or edit the information. The AMDIT database is edited by using the AMDIT program. Only administrators have access to the web-based program since it is only used to maintain and update the AMDIT database. The main capability of the AMDIT database is its ability to link APE Items to others widely used id systems numbers, such as NSN, DMWR, DODIC numbers. Figure 2 below provides a single edit page for the APE items.

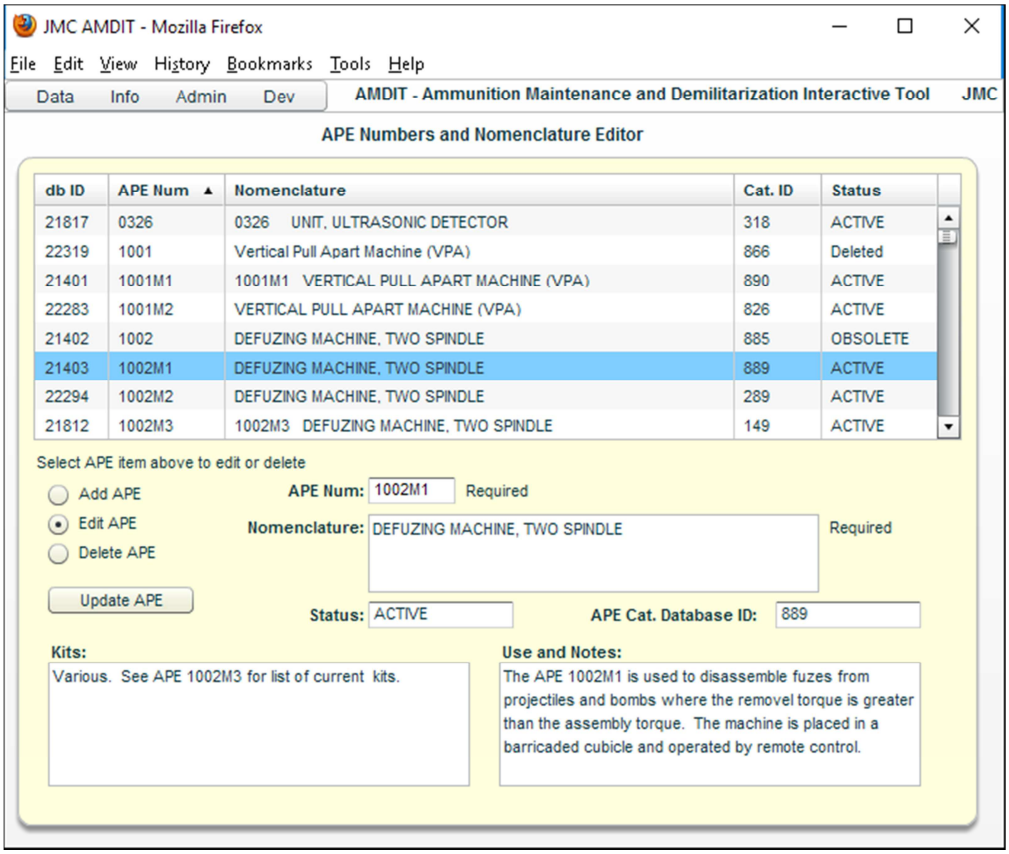


Figure 2: AMDIT APE Item Edit Page

The second main effort of Task 1 was to add a new feature in ProMap to directly access the AMDIT information. As the maps are constructed, and later viewed, users need to know what APE equipment and APE kits are available. This was accomplished by adding part numbers and/or NSN numbers to each part inside ProMap. This can be edited and viewed by the user. The information is pulled from AMDIT in real time as the user views or constructs the process map. Figure 3 below illustrates the new feature (noted with red ellipse).

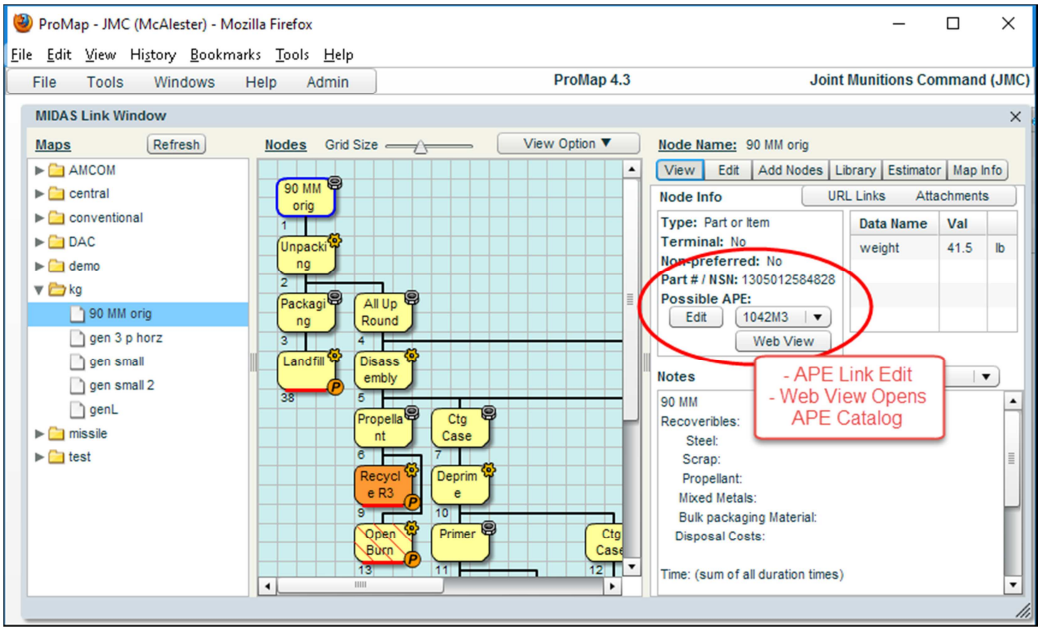


Figure 3: Typical Process Map in ProMap with Part or NSN Number
Notice Web View Button, used to Access APE Catalog at Rock Island

When the user clicks on the edit button, then additional information from the AMDIT database is presented to the user. The user can then associate any of the available APE items for that part or NSN number. It should be noted, that only data in the AMDIT database is available. If it has not been added to AMDIT, it will not be available. Figure 4 below gives a typical screen where the user can make the APE linking association.

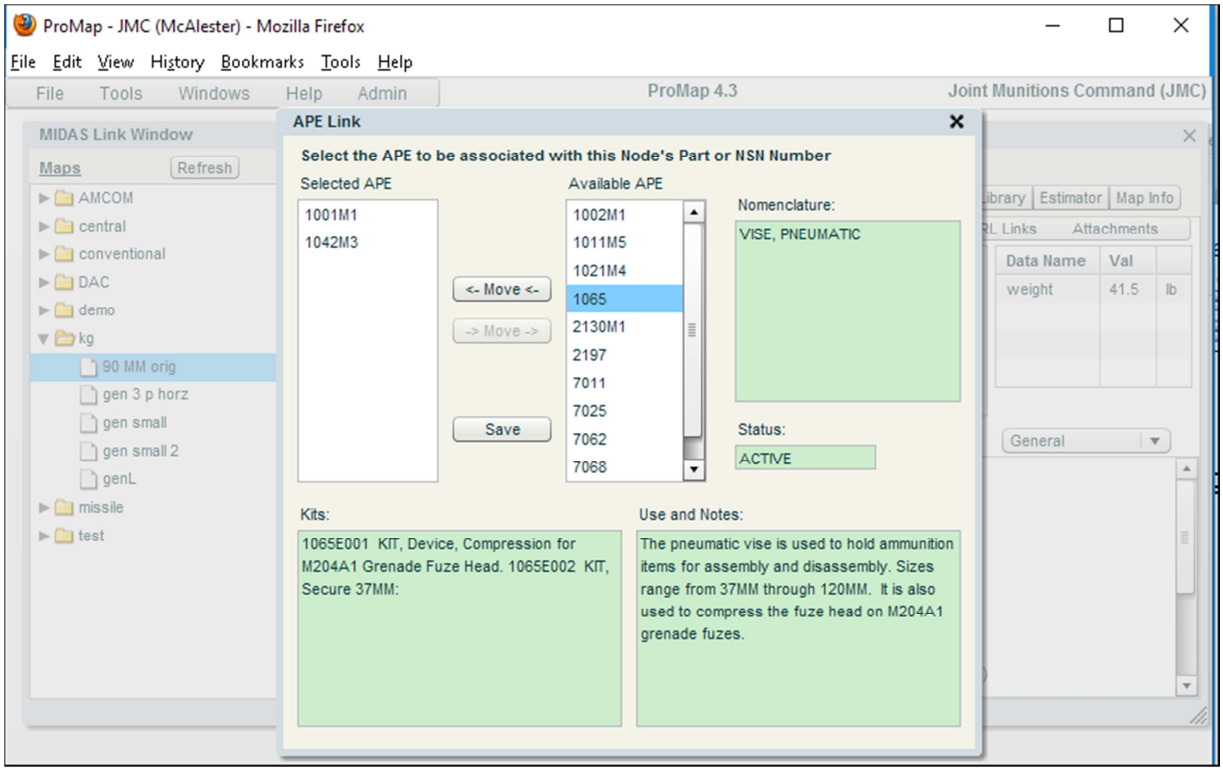


Figure 4: Linking Screen in ProMap that Allows User to Set APE Number Connections

The final objective of Task 1 was to allow the user of ProMap to view APE information from the APE Catalog web site hosted at Rock Island. The 'Web View' (see Fig. 3) is active when there is an item in the APE Catalog linked to that particular APE items. A new web page window will open with the information. Please note, only DoD computers are allow access to the APE Catalog. If the user is on a non-DOD computer, a blank web page will show.

TASK 2 - Quick Access Buttons in MIDAS to a Specific Process Map in ProMap

Task 2 included constructing a web service so that MIDAS can retrieve information from ProMap Final program changes where uploaded and tested on the JMC ProMap server at McAlester that allow MIDAS to request and obtain individual map information. This information is used to allow MIDAS users to open a specific map. A preliminary test page was operational for testing. However, due to funding delays by Argonne National Lab (ANL), buttons in MIDAS are not yet operational. Implementation in MIDAS is outside of this task and will be completed by ANL at a later date.

The Web Service developed on ProMap server can be called from MIDAS to request all current maps that are available for a given family of munitions. Only those maps in the central group can be opened. Other maps developed by other installations are not accessible due to proprietary concerns.

The Web Service WSDL can be obtained at

https://ProMap.army.mil/wsTechTree.asmx?WSDL

The actual method details are,

```
string getMapID (string strMapFamily, string keyID)
   strMapFamily – List of MIDAS Family Codes delimitated
                  with comma (no spaces)
   keyID – hardcoded access id to control access, currently "midas$4"
```

This method will return a MapID for a process map in ProMap (if it exists) for each family code in the input string, strMapFamily. The MapID can then be used to link directly to that Process Map in ProMap. The function call to open a particular map is

https://promap.army.mil/promap.aspx?mt=xx1234xxx&mapID=1234

Only maps in the central group are linkable at this time. The 'mt' is a random token and is created by MIDAS (different for each user). All users have permission to view maps in the central group. If there is no mapid variable, then ProMap will open without opening a particular map.

The web service returns a string formatted into XML containing various pieces of information about the item. The xml will contain a root node of "techtree". The xml will also contain a top section called "Header" and a content section named "Items". The "Header" section contains two elements titled "error" (no error or error message [none, invalid keyid]), and "ItemCount" (The number of family codes searched and returned). The "Items" section contains a "map" element for each record found. Each "map" has two parameters, "family" (the family code sent requested) and "permission" (indicates if the user has permission to us). The map value is the map ID. A map id of "-99" means no map was found in the ProMap database.

A complete XML example is given below:

```
<?xml version='1.0'?>
<techtree>
	<header>
		<error>none</error>
		<itemCount>3</itemCount>
	</header>
	<items>
		<map family='HMXX' permission='no'>-99</map>
		<map family='HMML' permission='yes'>2</map>
		<map family='HMSK' permission='yes'>3</map>
	</items>
</techtree>
```

TASK 3 - MIDAS Framework Import into ProMap

To assist users of ProMap to efficiently construct new process maps, a new feature that pulls MIDAS Munition Framework information was added to ProMap. Basically, a ProMap user enters a part number for a known munition in the MIDAS system, and then all part components and assembly information is returned to ProMap as a basic process map with just parts. The user then can enter the process map and add specific process between each part.

This feature was designed to save the user time in constructing an initial process made. Since the construction of the munition already exists in MIDAS, that information can now be transferred to ProMap to start the map. The user does not have to duplicate the part information. This also reduces errors when entering data. It should be noted that ProMap does not change any data in MIDAS nor does it provide data back to MIDAS. ProMap simply requests data from MIDAS.

A test system was set up and demonstrated in ProMap. It starts by the user requesting the part number, as shown in Fig. 5. MIDAS returns the part tree that is stored in the MIDAS database. The returned information is a basic XML file with nodes. Each part node includes its weight, name, sub-part or drawing number, weight units, and its parent ID number.

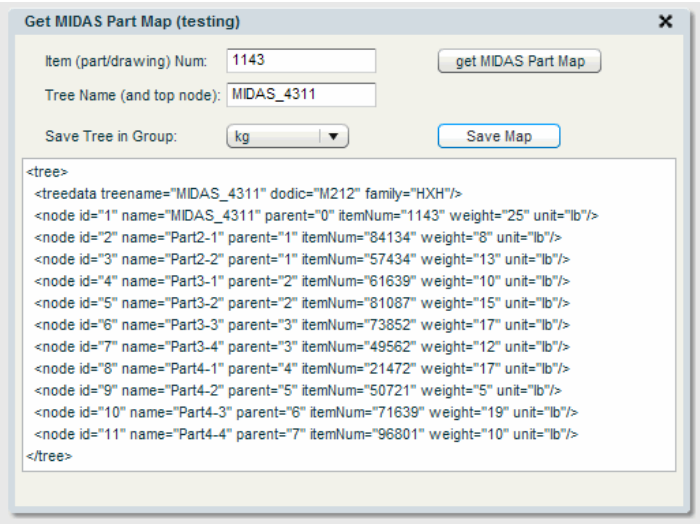


Figure 5. Test Window in ProMap for Requesting Part Map from MIDAS

The actual map is created in ProMap using the XML file. Each node is identified as the child of its parent, and the full map hierarchy is determined. The key element linking all parts is the parent ID. The final map is shown in Fig. 6. Note, the process map only has parts and no processes. The processes must be added after the part information is retrieved from MIDAS. This feature is to save time in construction a new process map, and not to do the actual final creation. Processes are not stored in MIDAS and must be added in ProMap.

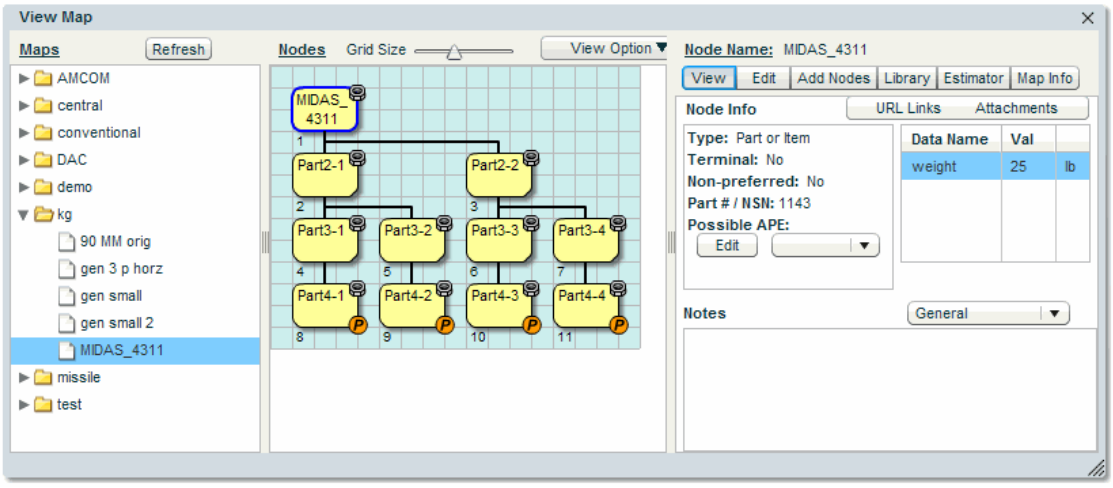


Figure 6. Process Map in ProMap based on Part Data from MIDAS (example)

This task is complete and can be implemented as soon as Argonne National Labs sets up a web service to access the MIDAS database. This project does not have direct access to MIDAS, and final connection to MIDAS will be coordinated with Argonne National Labs (ANL).

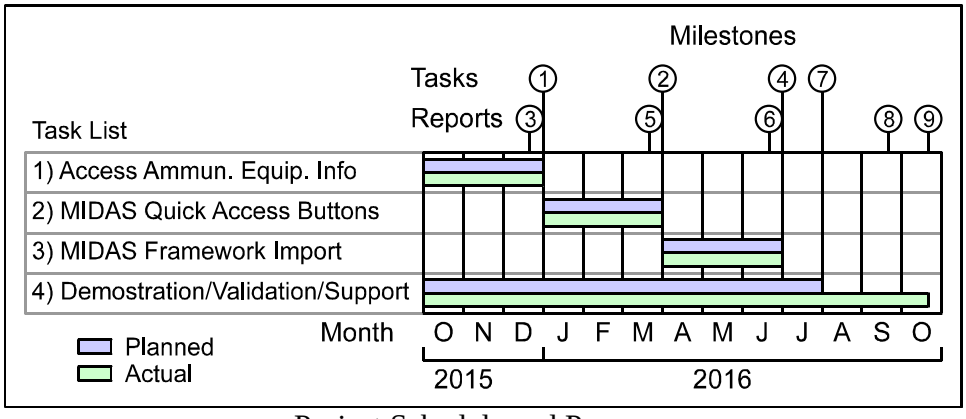
TASK 4 - Prototype Demonstration/validation Testing

Included in Task 4 was the support and maintenance of the various software tools used at MIDAS website. To better interface with other DoD systems, process maps needed to be exportable to XML file format. A revised output feature was implemented in ProMap so that any given process map could be exported in standard XML format as a single text file. This file can then be imported into other DoD systems, such as Shared Resources, so that it can be utilized with other programs. This effort did not implement new information into a process map. Included in the XML file was the full data information for each node, and the node organization (parent-child relationships).

As part of Task 4, Prototype Demonstration/validation Testing, the ProMap Web has been maintained and tested. The scripts for both ProMap programs were updated to allow web servers (Task 2 and 3). Various maintenance items were also completed. Web site certification was found to be invalid and steps were taken up correct this issue. Worked with JMC IT to correct server problems in August.

Milestone Status:

No.	Deliverable or Milestone	Due Date	Complete this Period	Cumulative Complete
1	Task 1: ProMap program update that accesses Ammunition Peculiar Equipment information	31 Dec 15	100%	100%
2	Task 2: MIDAS and ProMap program update that have access buttons in MIDAS to a Specific Process Map in ProMap	31 Mar 16	100%	100%
3	Quarterly Technical and Business Status Report	20 Dec 15	100%	100%
4	Task 3: ProMap program update that imports MIDAS	30 Jun 16	100%	100%
5	Quarterly Technical and Business Status Report	20 Mar 16	100%	100%
6	Quarterly Technical and Business Status Report	20 Jun 16	100%	100%
7	Task 4: ProMap demonstration/validation	31 Jul 16	100%	100%
8	Annual Technical and Quarterly Business Status Report	20 Sep 16	100%	100%
9	Final Technical and Business Report	20 Oct 16	100%	100%



Project Schedule and Progress

3.2 Technical Readiness Level Status and Technology Transfer Information:

Please indicate the current Technology Readiness Level (TRL) and technology transfer information for the prototype development effort based on the information requested and definitions in the chart (Insert chart number) below.

Technology Transition Information

1. Technology or technologies being worked on: Enhanced ability to construct and use process maps for the demilitarization of munitions. Using online database sharing to provide more information from multiple sources.

2. Is this technology an extension of a previous DOTC agreement or contract? No.

3. System to which technology can transition: Programming methods can be transitioned to other MIDAS software tools such as MyQC and OBODM programs.

4. Commercial applications if applicable: none

5. Government organizations or DoD Armed Force Services interested in technology other than AOR's organization: None known.

6. DoD Armed force services or organizations that could benefit from technology (not mentioned above): Army, Navy, Air Force, and Marine Corps that need to construct process maps for demilitarization

7. Initial Technology Readiness Level (TRL) of technology at the start of agreement: 4

8. Current Technology Readiness Level (TRL) of technology: 5

9. Final Technology Readiness Level (TRL) of technology expected at end of agreement: 8

10. Next step in technology transition process: Not applicable at this time

Technology Readiness Levels in the Department of Defense (DOD)
(Source: DOD (2006), *Defense Acquisition Guidebook*)

Technology Readiness Level	Description
1. Basic principles observed and reported	Lowest level of technology readiness. Scientific research begins to be translated into applied research and development. Example might include paper studies of a technology's basic properties.
2. Technology concept and/or application formulated	Invention begins. Once basic principles are observed, practical applications can be invented. The application is speculative and there is no proof or detailed analysis to support the assumption. Examples are still limited to paper studies.
3. Analytical and experimental critical function and/or characteristic proof of concept	Active research and development is initiated. This includes analytical studies and laboratory studies to physically validate analytical predictions of separate elements of the technology. Examples include components that are not yet integrated or representative.
4. Component and/or breadboard validation in laboratory environment	Basic technological components are integrated to establish that the pieces will work together. This is "low fidelity" compared to the eventual system. Examples include integration of 'ad hoc' hardware in a laboratory.
5. Component and/or breadboard validation in relevant environment	Fidelity of breadboard technology increases significantly. The basic technological components are integrated with reasonably realistic supporting elements so that the technology can be tested in a simulated environment. Examples include 'high fidelity' laboratory integration of components.
6. System/subsystem model or prototype demonstration in a relevant environment	Representative model or prototype system, which is well beyond the breadboard tested for TRL 5, is tested in a relevant environment. Represents a major step up in a technology's demonstrated readiness. Examples include testing a prototype in a high fidelity laboratory environment or in simulated operational environment.
7. System prototype demonstration in an operational environment	Prototype near or at planned operational system. Represents a major step up from TRL 6, requiring the demonstration of an actual system prototype in an operational environment, such as in an aircraft, vehicle or space. Examples include testing the prototype in a test bed aircraft.
8. Actual system completed and 'flight qualified' through test and demonstration	Technology has been proven to work in its final form and under expected conditions. In almost all cases, this TRL represents the end of true system development. Examples include developmental test and evaluation of the system in its intended weapon system to determine if it meets design specifications.

3.3 Problems Encountered and Action Taken

- Changes to the initiative objective or schedule: None
- Technical problems and approach to correct: None
- Schedule problems and approach to correct:
    - JMC McAlester will coordinated with ANL to fund and implement results
    - Implementation into MIDAS system is outside this contract
- Risks identified and mitigation plan: None

3.4 Non-Traditional Defense Contractor Participation

Name of Nontraditional*	Planned Start Date	Actual Start Date	Reason for Deviation from Plan
Gramago, LLC	24 Sep 15	24 Sep 15	NA